

Issuing Laboratory:
Intertek Testing Services Hong Kong Limited

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TEST REPORT

Report Number: 13121178HKG-003

Application
For
Certification
(Original Grant)
(FCC ID: 2ABQ3-STG001)

Transceiver

Prepared and Checked by:

A handwritten signature in black ink, appearing to read 'Wong Kwok Yeung'.

Wong Kwok Yeung, Kenneth
Lead Engineer

Approved by:

A handwritten signature in black ink, appearing to read 'Chan Chi Hung'.

Chan Chi Hung, Terry
Supervisor
08 Apr, 2014

The test report only allows to be revised within the retention period unless further standard or the requirement was notified.
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GENERAL INFORMATION

Applicant Name:	Systech Electronics Ltd.
Applicant Address:	26/F, Lever Tech Centre, 69-71 King Yip Street, Kwun Tong, Kowloon, Hong Kong.
Manufacturer Name:	Victory Concept Electronics Ltd.
Manufacturer Address:	Units 905 & 918, 9/F, Lu Plaza, 2 Wing Yip Street, Kwun Tong, Kowloon, Hong Kong
FCC Specification Standard:	FCC Part 15, October 1, 2012 Edition
FCC ID:	2ABQ3-STG001
FCC Model(s):	TAGGO
Type of EUT:	Digital Transmission System
Description of EUT:	Wireless Tracker
Serial Number:	Not Labelled
Sample Receipt Date:	Feb 15, 2014
Date of Test:	Feb 15, 2014 to Mar 03, 2014
Report Date:	Apr 08, 2014
Environmental Conditions:	Temperature: +10 to 40°C Humidity: 10 to 90%

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EXHIBIT 1
SUMMARY OF TEST RESULTS & STATEMENT OF COMPLIANCE

1.0 Summary of Test Results

Test Items	FCC Part 15 Section	Results	Details see section
Antenna Requirement	15.203	Pass	2.1
Max. Conducted Output Power	15.247(b)(3)&(4)	Pass	4.1
Min. 6dB RF Bandwidth	15.247(a)(2)	Pass	4.2
Max. Power Density	15.247(e)	Pass	4.3
Out of Band Antenna Conducted Emission	15.247(d)	Pass	4.4
Radiated Emission in Restricted Bands and Spurious Emissions	15.247(d), 15.209 & 15.109	Pass	4.6

Note: Pursuant to FCC Part 15 Section 15.215(c), the 20dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over expected variations in temperature and supply voltage were considered.

1.1 Statement of Compliance

The equipment under test is found to be complying with the following standards:

FCC Part 15, October 1, 2012 Edition

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EXHIBIT 2 GENERAL DESCRIPTION

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2.0 General Description

2.1 Product Description

The equipment under test (EUT) is a portable Bluetooth Wireless Tracker. The EUT contains a Bluetooth 4.0 transceiver. The Bluetooth 4.0 transceiver in the EUT is operating in the frequency range from 2402MHz to 2480MHz (40 channels with 2MHz channel spacing). The EUT is powered by 3.0 VDC (1 X 3.0V CR2016 battery).

The antenna used in the EUT is internal and integral.

The circuit description is saved with filename: descri.pdf.

2.2 Related Submittal(s) Grants

This is a single application for certification of a transceiver.

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2.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.4 (2009). Preliminary radiated scans and all radiated measurements were performed in Open Area Test Sites. All Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application. Antenna port conducted measurements were performed according to ANSI C63.10 (2009) and KDB Publication No. 558074 D01 v03r01(09-April-2013).

2.4 Test Facility

The open area test site and antenna port conducted measurement facility used to collect the radiated data and conductive data are at Roof Top and 2nd Floor respectively of Intertek Testing Services Hong Kong Ltd., which is located at Garment Centre, 576 Castle Peak Road, Kowloon, Hong Kong. This test facility and site measurement data have been fully placed on file with the FCC.

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EXHIBIT 3
SYSTEM TEST CONFIGURATION

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3 System Test Configuration

3.1 Justification

For radiated emissions testing, the equipment under test (EUT) was setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, all cables (if any) were manipulated to produce worst case emissions.

The EUT was powered by 1 X 3.0V CR2016 new battery.

For the measurements, the EUT was attached to a plastic stand if necessary and placed on the wooden turntable. If the EUT attached to peripherals, they were connected and operational (as typical as possible).

The signal was maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization were varied during the search for maximum signal level. The antenna height was varied from 1 to 4 meters. Radiated emissions were taken at three meters unless the signal level was too low for measurement at that distance. If necessary, a pre-amplifier was used and/or the test was conducted at a closer distance.

Radiated emission measurement for transmitter were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

Emission that are directly caused by digital circuits in the transmit path and transmitter portion were measured, and the limit are according to FCC Part 15 Section 15.209. Digital circuitry used to control additional functions other than the operation of the transmitter is subject to FCC Part 15 Section 15.109 Limits.

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3.1 Justification – Cont'd

Detector function for radiated emissions was in peak mode. Average readings, when required, were taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings.

Determination of pulse desensitization was made according to *Hewlett Packard Application Note 150-2, Spectrum Analysis... Pulsed RF*. The effective period (Teff) was referred to Exhibit 4.6.3. With the resolution bandwidth 1MHz and spectrum analyzer IF bandwidth 3dB, the pulse desensitization factor was 0dB.

All relevant operation modes have been tested, and the worst case data is included in this report.

3.2 EUT Exercising Software

The EUT exercise program (if any) used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use.

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3.3 Details of EUT and Description of Accessories

N/A

3.4 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

Uncertainty and Compliance - Unless the standard specifically states that measured values are to be extended by the measurement uncertainty in determining compliance, all compliance determinations are based on the actual measured value.

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EXHIBIT 4
TEST RESULTS

4 Test Results

4.1 Maximum Conducted Output Power at Antenna Terminals

The antenna port of the EUT was connected to the input of a spectrum analyzer.

- External attenuation and cable loss were compensated for using the OFFSET function of the analyser. The measurement procedure 9.1.1 was used.
- The EUT should be configured to transmit continuously (at a minimum duty cycle of 98%) at full power over the measurement duration. The measurement procedure AVG1 was used.

Antenna Gain = 0.5 dBi		
Frequency (MHz)	Output in dBm	Output in mWatt
Low Channel:	-6.69	0.214
Middle Channel:	-6.19	0.240
High Channel:	-6.05	0.248

Cable loss : 1.0 dB External Attenuation : 0 dB

Cable loss, external attenuation: included in OFFSET function
 added to SA raw reading

Limits:

- 1W (30dBm) for antennas with gains of 6dBi or less
- ___W (___dBm) for antennas with gains more than 6dBi

The plots of conducted output power are saved as below.

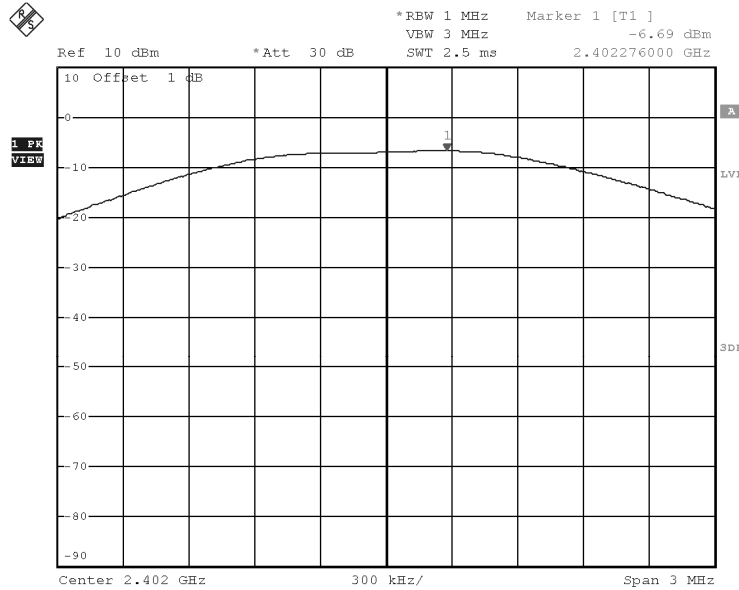
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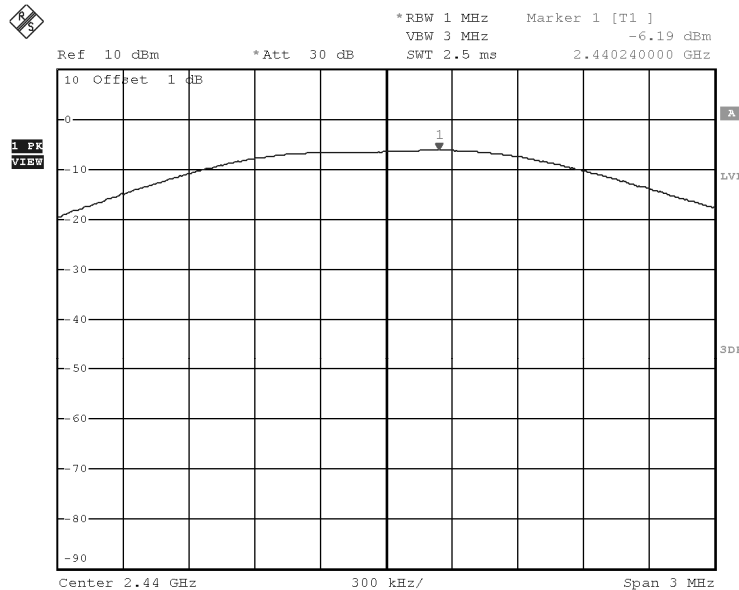
Plots of maximum output power

Lowest channel 2402MHz



Date: 25.FEB.2014 16:33:50

Middle channel 2440MHz



Date: 25.FEB.2014 16:34:35

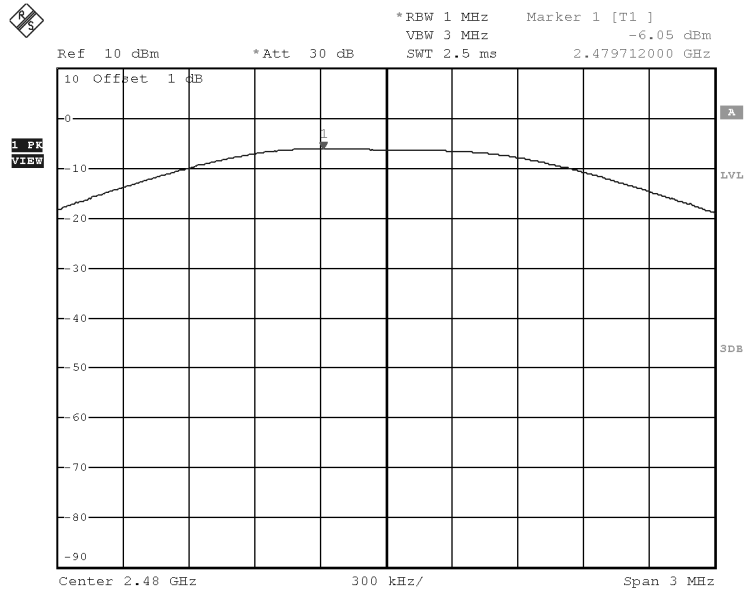
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Plots of maximum output power

Highest channel 2480MHz



Date: 25.FEB.2014 16:29:39

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4.2 Minimum 6dB RF Bandwidth

The antenna port of the EUT was connected to the input of a spectrum analyzer. The 8.1 EBW measurement procedure was used. A PEAK output reading was taken, a DISPLAY line was drawn 6dB lower than PEAK level. The 6dB bandwidth was determined from where the channel output spectrum intersected the display line.

Frequency (MHz)	6dB Bandwidth (MHz)
Low Channel: 2402	0.72
Middle Channel: 2440	0.72
High Channel: 2480	0.71

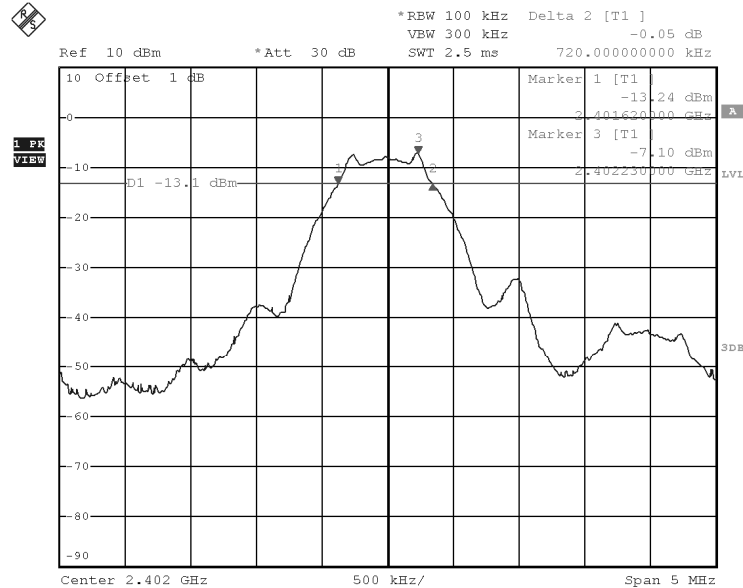
Limits :

6 dB bandwidth shall be at least 500kHz

The plots of 6dB RF bandwidth and occupied bandwidth are saved as below.

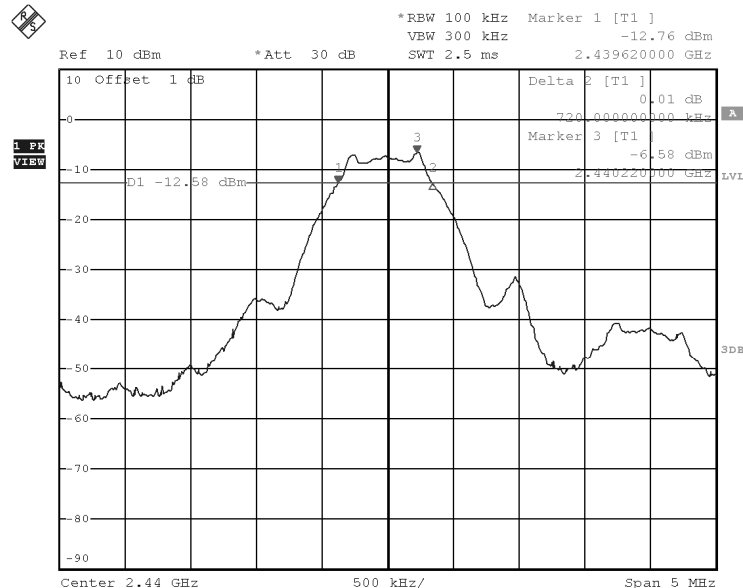
Plots of 6dB RF bandwidth

Lowest Channel 2402MHz



Date: 25.FEB.2014 15:56:25

Middle Channel 2440MHz



Date: 25.FEB.2014 16:05:39

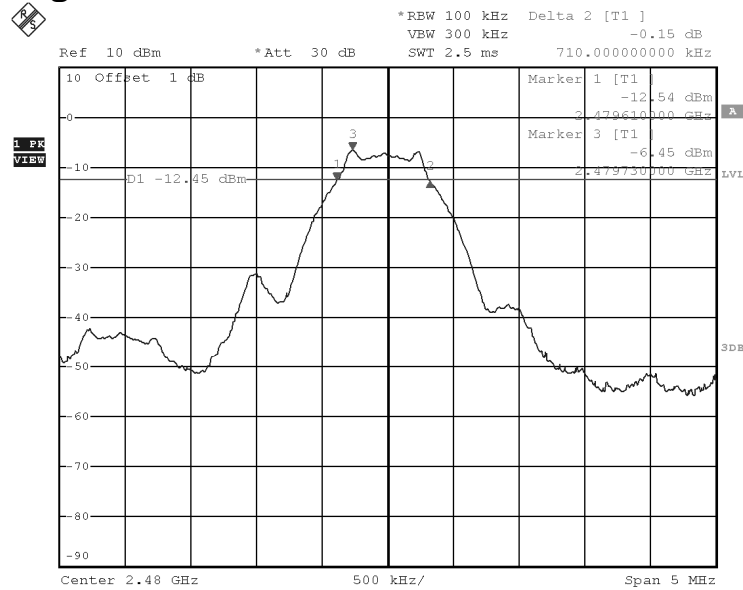
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Plots of 6dB RF bandwidth

Highest Channel 2480MHz



Date: 25.FEB.2014 16:22:06

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4.3 Maximum Power Spectral Density

Antenna output of the EUT was coupled directly to spectrum analyzer. The measurement procedure 10.2 PKPSD was used. If an external attenuator and/or cable was used, these losses are compensated for using the OFFSET function of the analyser.

Frequency (MHz)	PSD in 100kHz (dBm)
Low Channel: 2402	-7.00
Middle Channel: 2440	-6.59
High Channel: 2480	-6.37

Cable Loss: 1.0 dB

Limit: 8dBm

The plots of power spectral density are as below.

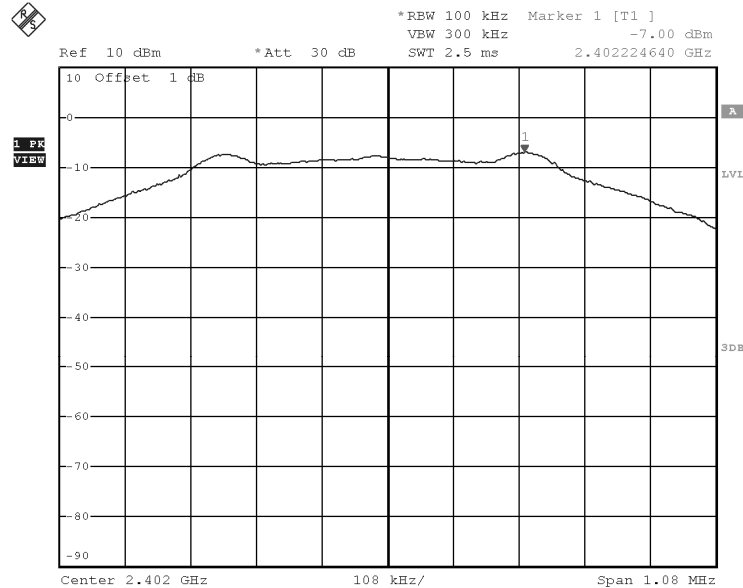
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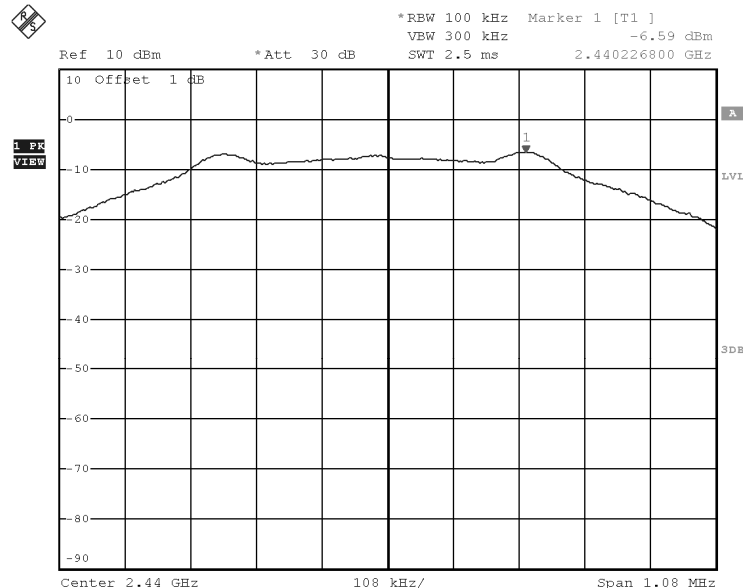
Plots of power spectral density in 100kHz

Lowest channel 2402MHz



Date: 25.FEB.2014 17:46:54

Middle channel 2440MHz



Date: 25.FEB.2014 17:51:35

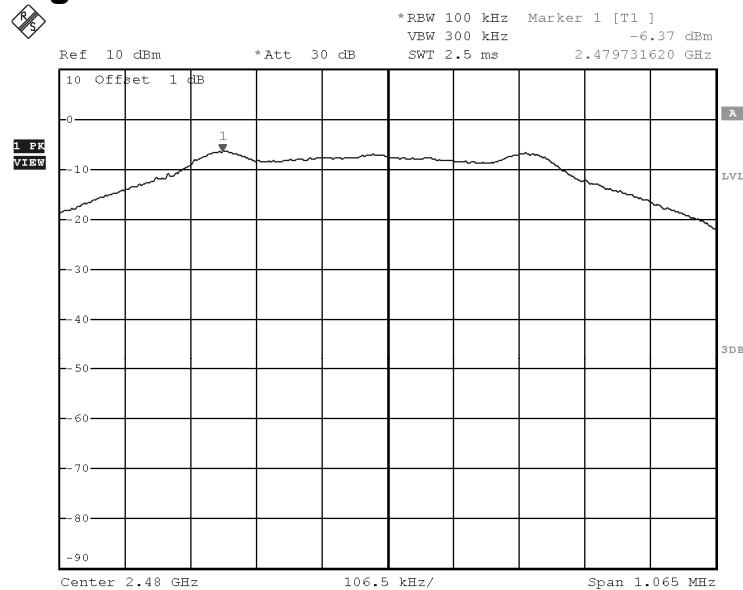
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Plots of power spectral density in 100kHz

Highest channel 2480MHz



Date: 25.FEB.2014 17:54:59

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4.4 Out of Band Conducted Emissions

RBW was set to 1MHz rather than 100KHz in order to increase the measurement speed.

The display line (in red) shown in the following plots denotes the limit at 20dB below maximum measured in-band peak PSD level in 100KHz bandwidth. The traces in the following plots are measured with 1MHz RBW but not 100KHz in measurement range from 10MHz to 2GHz and 2.8GHz to 25GHz.

The measurement procedures under sections 11 of KDB558074 were used.

Limits:

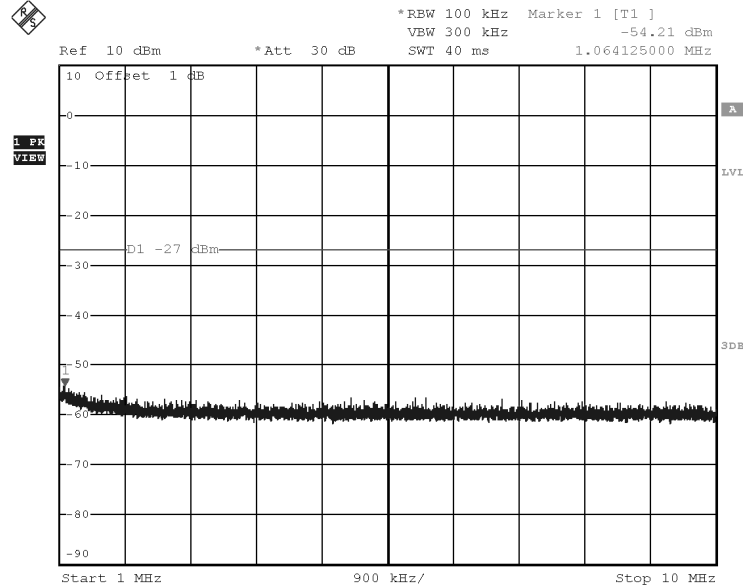
All spurious emission and up to the tenth harmonic was measured and they were found to be at least 20 dB below the maximum measured in-band peak PSD level .

The plots of out of band conducted emissions are as below.

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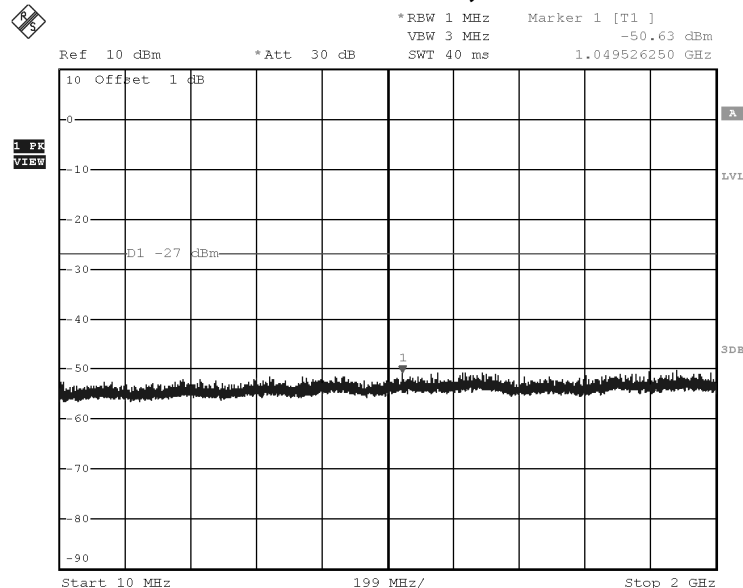
Plots of out of band conducted emissions

Lowest Channel 2402MHz, Plot A



Date: 25.FEB.2014 18:51:19

Lowest Channel 2402MHz, Plot B



Date: 25.FEB.2014 18:52:18

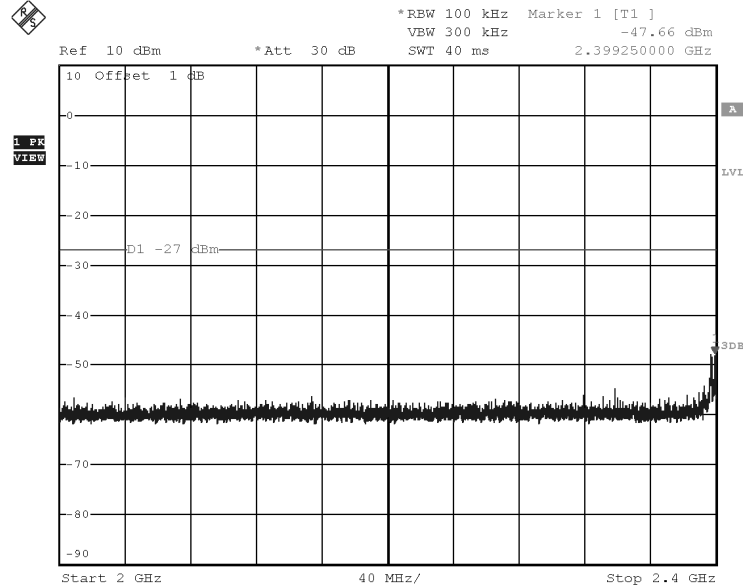
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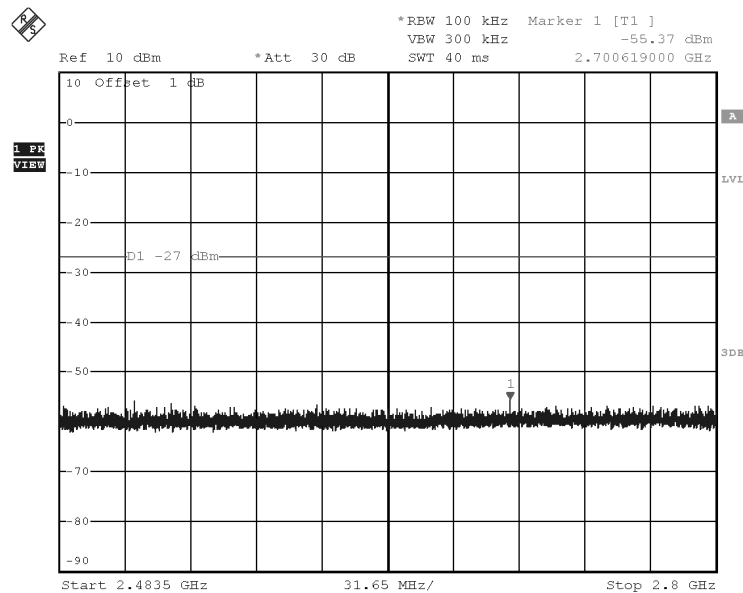
Plots of out of band conducted emissions

Lowest Channel 2402MHz, Plot C



Date: 25.FEB.2014 18:53:24

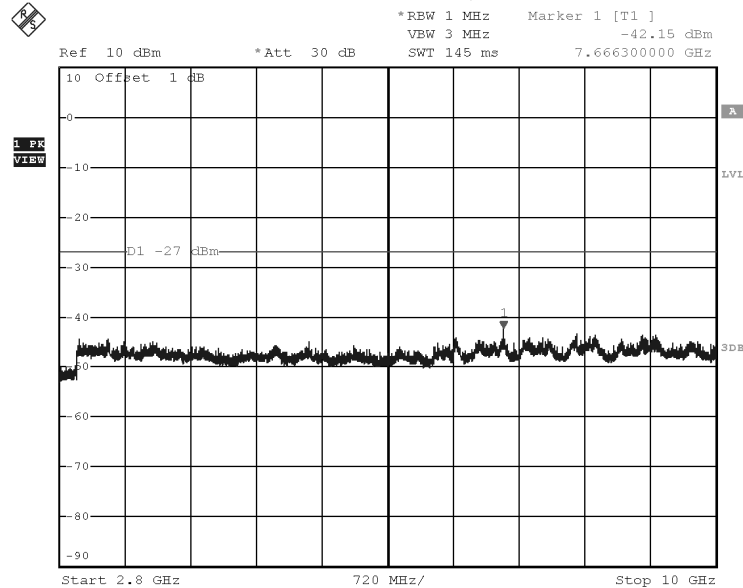
Lowest Channel 2402MHz, Plot D



Date: 25.FEB.2014 18:54:20

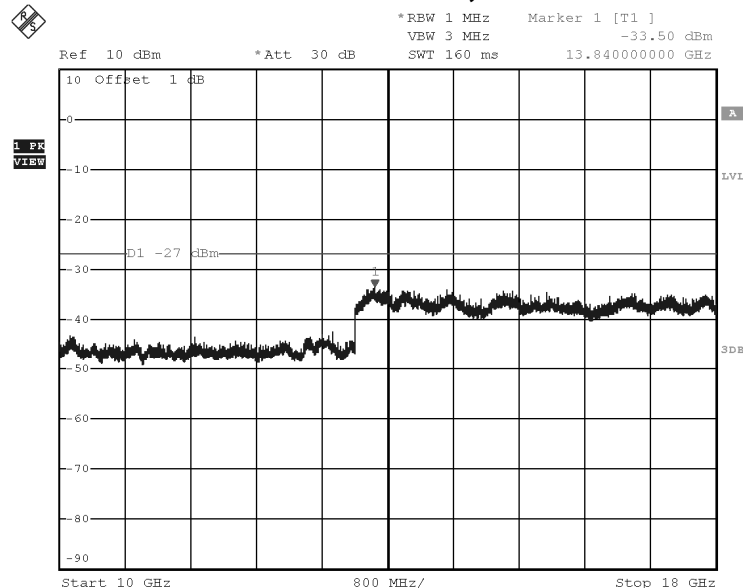
Plots of out of band conducted emissions

Lowest Channel 2402MHz, Plot E



Date: 25.FEB.2014 18:55:49

Lowest Channel 2402MHz, Plot F



Date: 25.FEB.2014 18:56:37

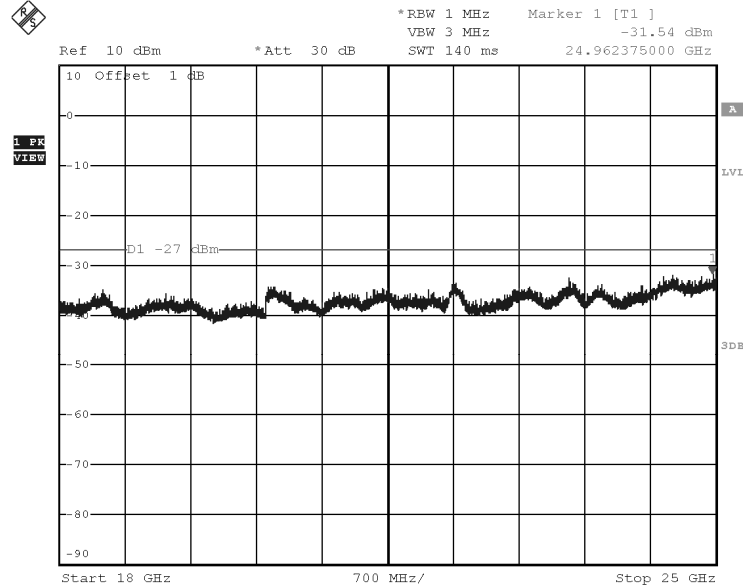
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Plots of out of band conducted emissions

Lowest Channel 2402MHz, Plot G



Date: 25.FEB.2014 18:57:34

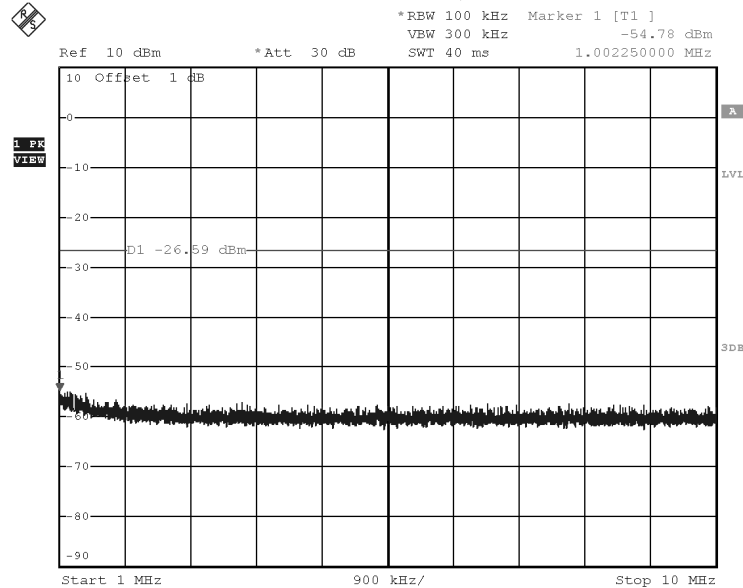
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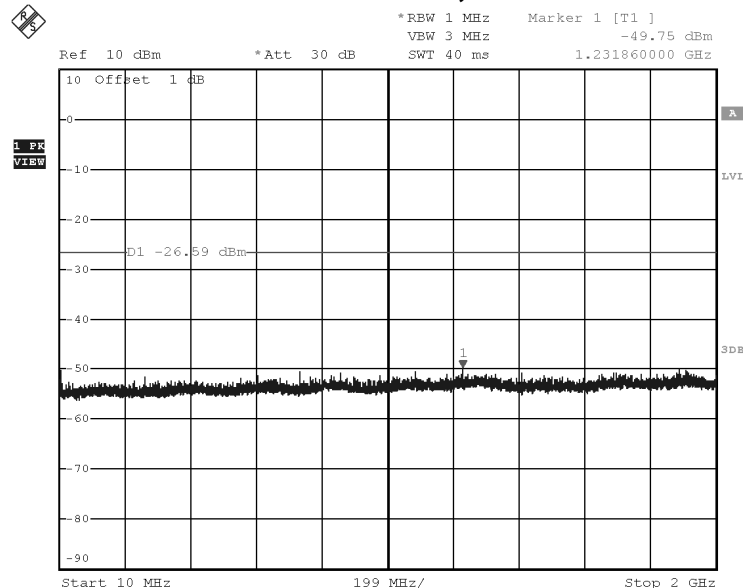
Plots of out of band conducted emissions

Middle Channel 2440MHz, Plot A



Date: 25.FEB.2014 18:49:15

Middle Channel 2440MHz, Plot B



Date: 25.FEB.2014 18:48:07

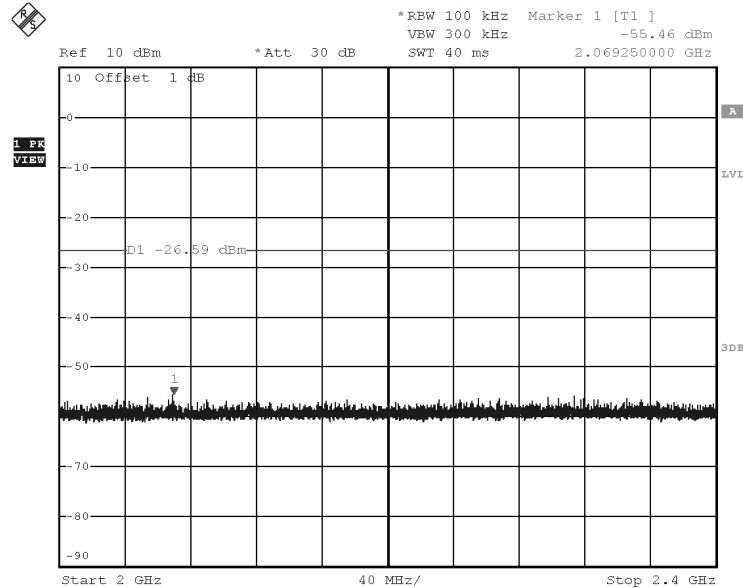
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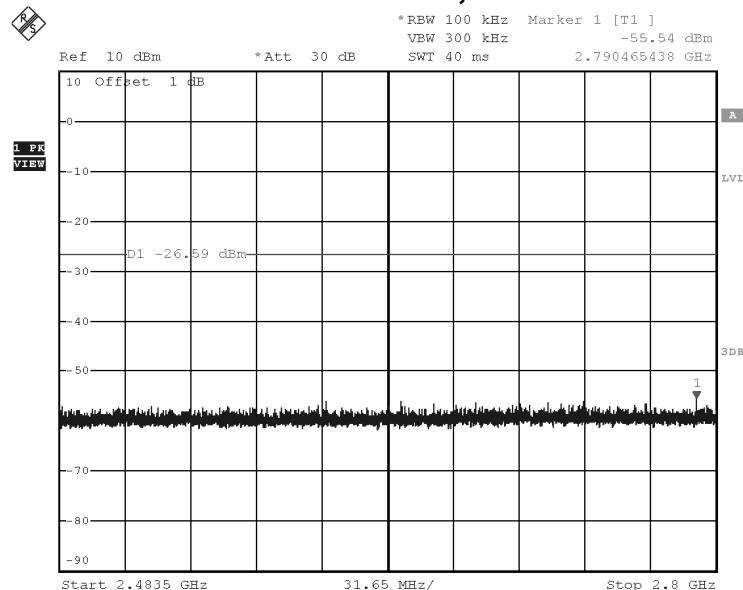
Plots of out of band conducted emissions

Middle Channel 2440MHz, Plot C



Date: 25.FEB.2014 18:46:41

Middle Channel 2440MHz, Plot D



Date: 25.FEB.2014 18:44:33

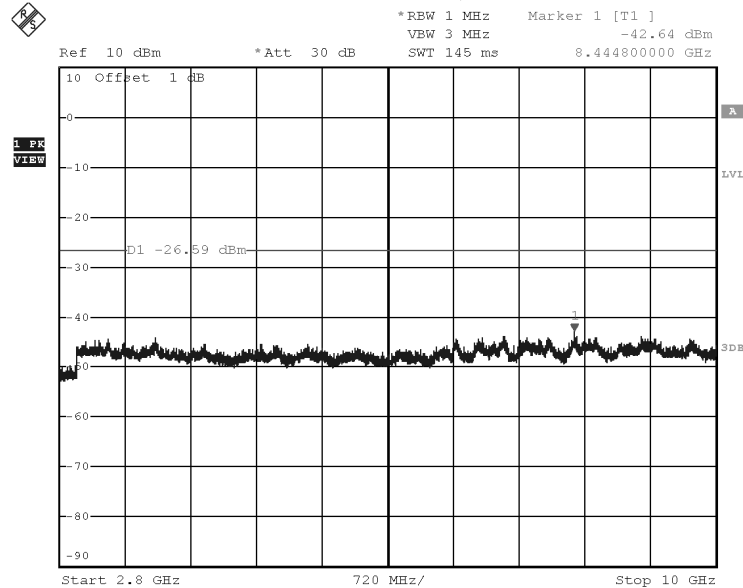
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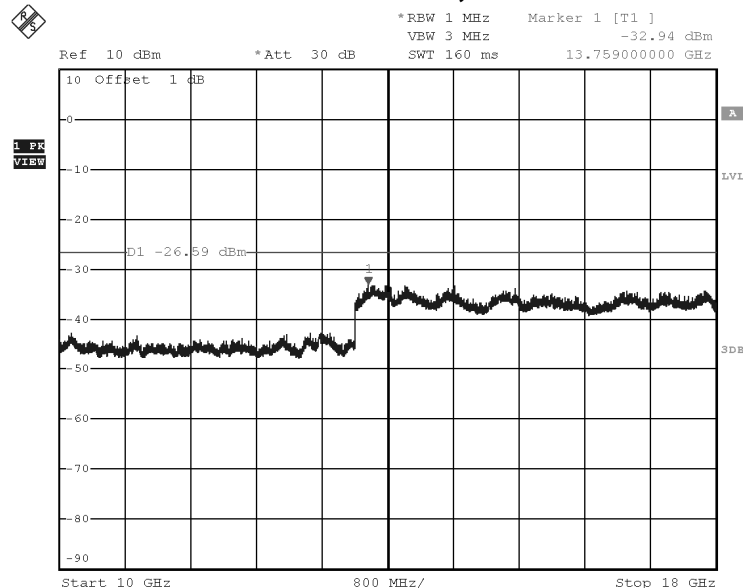
Plots of out of band conducted emissions

Middle Channel 2440MHz, Plot E



Date: 25.FEB.2014 18:43:24

Middle Channel 2440MHz, Plot F



Date: 25.FEB.2014 18:42:10

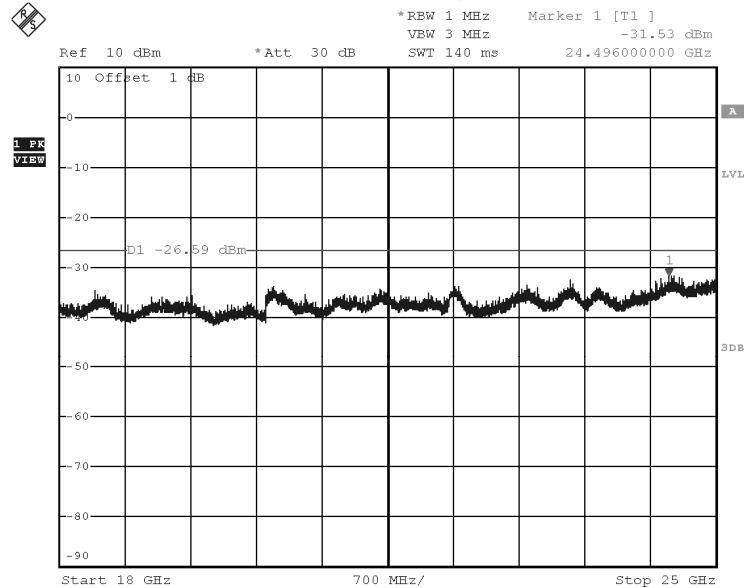
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Plots of out of band conducted emissions

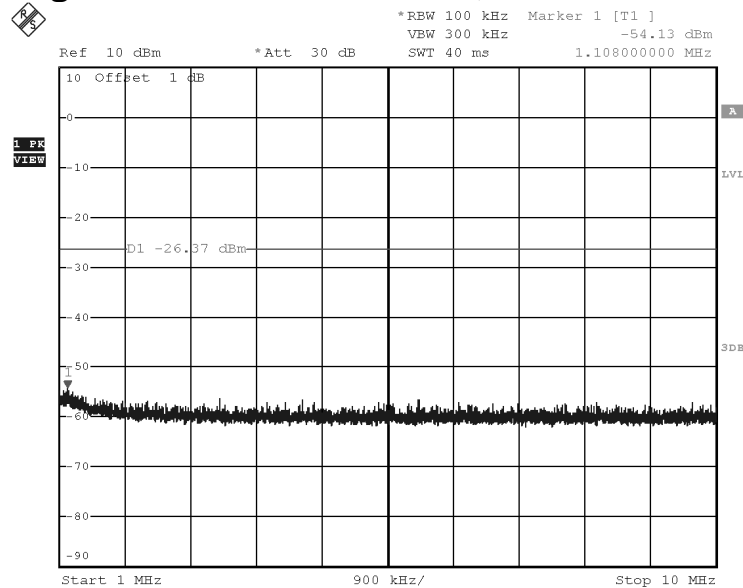
Middle Channel 2440MHz, Plot G



Date: 25.FEB.2014 18:38:39

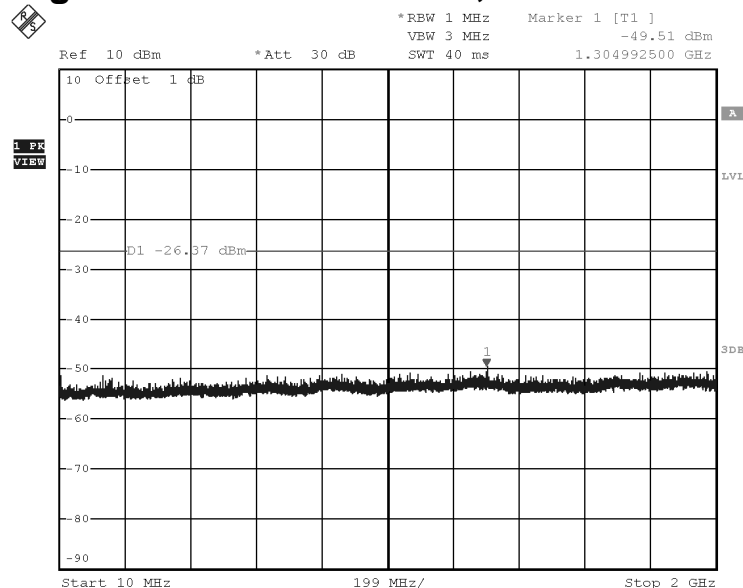
Plots of out of band conducted emissions

Highest Channel 2480MHz, Plot A



Date: 25.FEB.2014 18:24:41

Highest Channel 2480MHz, Plot B



Date: 25.FEB.2014 18:26:06

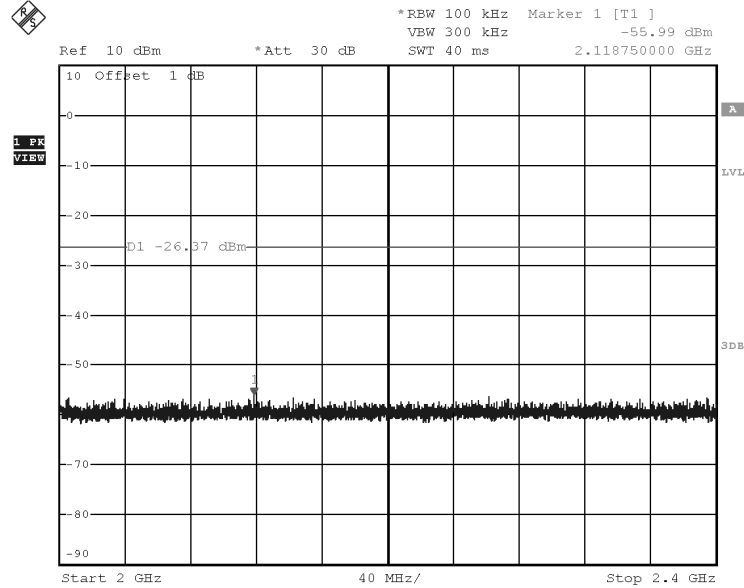
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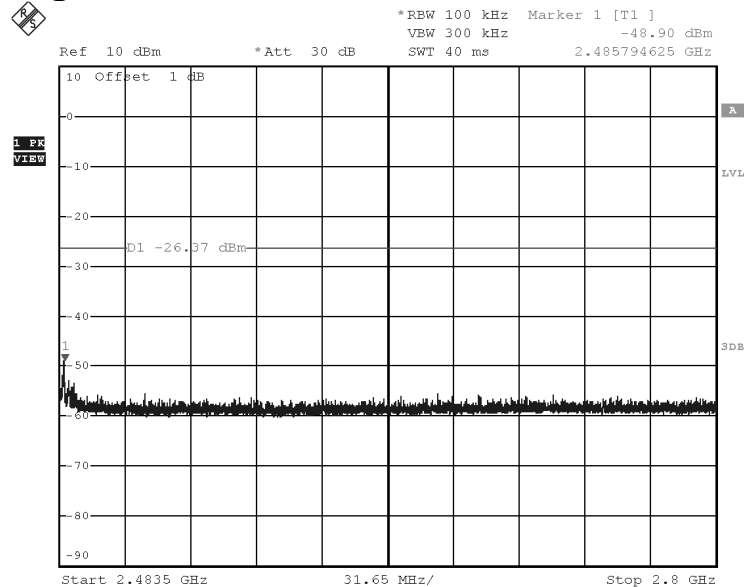
Plots of out of band conducted emissions

Highest Channel 2480MHz, Plot C



Date: 25.FEB.2014 18:27:35

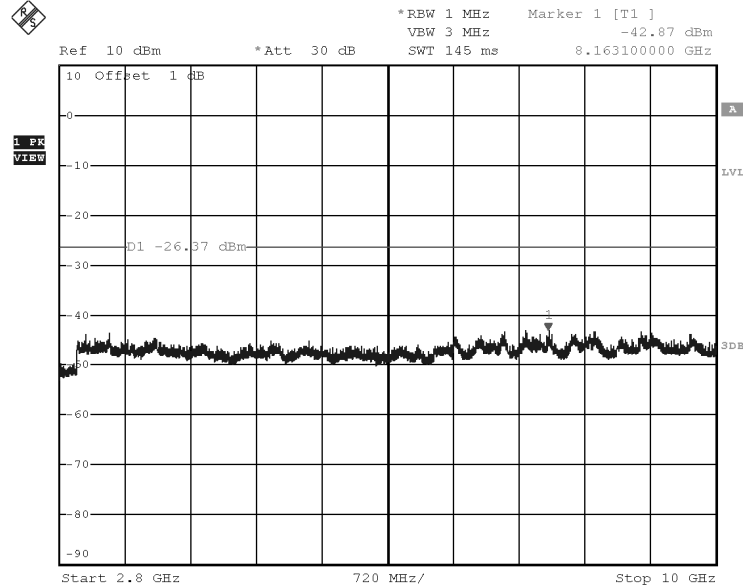
Highest Channel 2480MHz, Plot D



Date: 25.FEB.2014 18:32:11

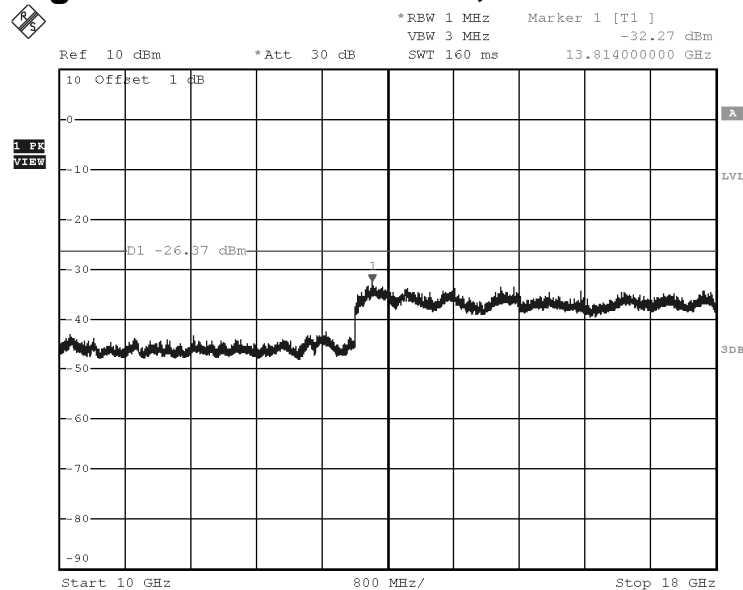
Plots of out of band conducted emissions

Highest Channel 2480MHz, Plot E



Date: 25.FEB.2014 18:33:46

Highest Channel 2480MHz, Plot F



Date: 25.FEB.2014 18:35:43

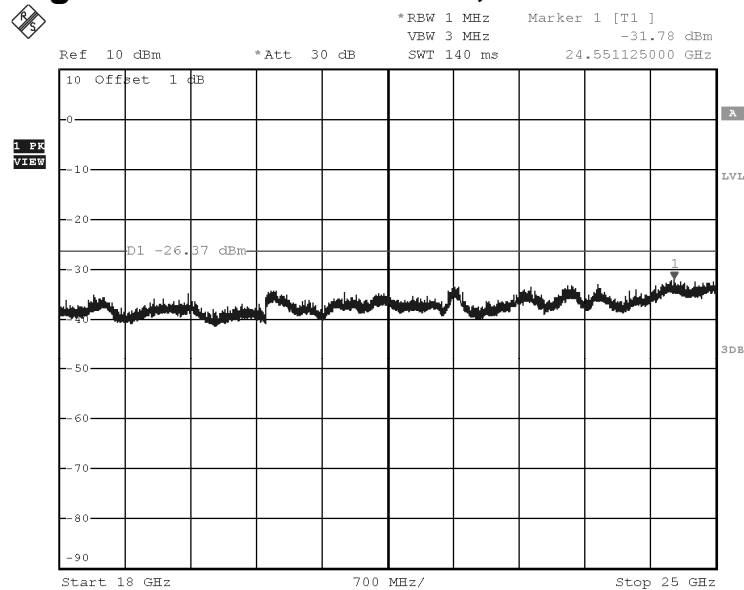
Issuing Laboratory:
Intertek Testing Services Hong Kong Limited

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Plots of out of band conducted emissions

Highest Channel 2480MHz, Plot G



Date: 25.FEB.2014 18:37:11

4.5 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

$$FS = RA + AF + CF - AG + PD + AV$$

Where

- FS = Field Strength in dB μ V/m
- RA = Receiver Amplitude (including preamplifier) in dB μ V
- CF = Cable Attenuation Factor in dB
- AF = Antenna Factor in dB
- AG = Amplifier Gain in dB
- PD = Pulse Desensitization in dB
- AV = Average Factor in -dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

$$FS = RA + AF + CF - AG + PD + AV$$

Example

Assume a receiver reading of 62.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29.0 dB is subtracted. The pulse desensitization factor of the spectrum analyzer is 0.0 dB, and the resultant average factor is -10.0 dB. The net field strength for comparison to the appropriate emission limit is 32.0 dB μ V/m. This value in dB μ V/m is converted to its corresponding level in μ V/m.

RA = 62.0 dB μ V
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
PD = 0.0 dB
AV = -10 dB

$$FS = 62.0 + 7.4 + 1.6 - 29.0 + 0.0 + (-10.0) = 32.0 \text{ dB}\mu\text{V/m}$$

$$\text{Level in } \mu\text{V/m} = \text{Common Antilogarithm } [(32.0 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

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4.6 Transmitter Radiated Emissions in Restricted Bands and Spurious Emissions

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

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4.6.1 Radiated Emission Configuration Photograph

Worst Case Restricted Band Radiated Emission
at

2483.500MHz

The worst case radiated emission configuration photographs are saved with filename: config photos.pdf

4.6.2 Radiated Emission Data

The data in tables 1-4 list the significant emission frequencies, the limit and the margin of compliance.

Judgement -

Passed by 1.0 dB margin compare with average limit

4.6.2 Radiated Emissions Data

Mode: Lowest Channel 2402MHz - Transmission

Table 1

Radiated Emission Data

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Average (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
V	2390.000	56.1	33	29.4	52.5	54.0	-1.5
V	4804.000	43.4	33	34.9	45.3	54.0	-8.7
V	12010.000	37.5	33	40.5	45.0	54.0	-9.0

Remark: Average detector is used for the emission measurement.

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
V	2390.000	61.1	33	29.4	57.5	74.0	-16.5
V	4804.000	45.6	33	34.9	47.5	74.0	-26.5
V	12010.000	40.3	33	40.5	47.8	74.0	-26.2

Remark: Peak detector is used for the emission measurement.

NOTES:

1. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
2. Negative value in the margin column shows emission below limit.
3. Horn antenna is used for the emission over 1000MHz.
4. Emission (the row indicated by **bold**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.

Mode: Middle Channel 2440MHz - Transmission

Table 2

Radiated Emission Data

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Average (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
V	4880.000	43.7	33	34.9	45.6	54.0	-8.4
V	7320.000	38.2	33	37.9	43.1	54.0	-10.9
V	12200.000	37.9	33	40.5	45.4	54.0	-8.6

Remark: Average detector is used for the emission measurement.

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
V	4880.000	44.9	33	34.9	46.8	74.0	-27.2
V	7320.000	41.0	33	37.9	45.9	74.0	-28.1
V	12200.000	40.4	33	40.5	47.9	74.0	-26.1

Remark: Peak detector is used for the emission measurement.

NOTES:

1. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
2. Negative value in the margin column shows emission below limit.
3. Horn antenna is used for the emission over 1000MHz.
4. Emission (the row indicated by **bold**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.

Mode: Highest Channel 2480MHz - Transmission

Table 3

Radiated Emission Data

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Average (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
V	2483.500	56.6	33	29.4	53.0	54.0	-1.0
V	4960.000	43.8	33	34.9	45.7	54.0	-8.3
V	7440.000	38.3	33	37.9	43.2	54.0	-10.8
V	12400.000	38.3	33	40.5	45.8	54.0	-8.2

Remark: Average detector is used for the emission measurement.

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m - Peak (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
V	2483.500	61.6	33	29.4	58.0	74.0	-16.0
V	4960.000	44.7	33	34.9	46.6	74.0	-27.4
V	7440.000	40.9	33	37.9	45.8	74.0	-28.2
V	12400.000	40.2	33	40.5	47.7	74.0	-26.3

Remark: Peak detector is used for the emission measurement.

NOTES:

1. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
2. Negative value in the margin column shows emission below limit.
3. Horn antenna is used for the emission over 1000MHz.
4. Emission (the row indicated by **bold**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.

Mode: Operate & digital part

Table 4
Radiated Emission Data

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-amp (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
V	33.856	38.8	16	10.0	32.8	40.0	-7.2
V	38.590	39.3	16	10.0	33.3	40.0	-6.7
V	42.950	38.8	16	10.0	32.8	40.0	-7.2
V	48.950	38.7	16	11.0	33.7	40.0	-6.3
V	56.980	38.2	16	11.0	33.2	40.0	-6.8
V	75.960	44.0	16	6.0	34.0	40.0	-6.0

- NOTES: 1. Quasi-Peak detector is used for the emission measurement.
2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Emission (the row indicated by **bold**) within the restricted band meets the requirement of FCC Part 15 Section 15.205.

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4.6.3 Transmitter Duty Cycle Calculation

Not applicable – No average factor is required.

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EXHIBIT 5
EQUIPMENT LIST

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5.0 Equipment List

1) Radiated Emissions Test

Equipment	Biconical Antenna	Log Periodic Antenna	EMI Test Receiver
Registration No.	EW-0571	EW-0446	EW-2251
Manufacturer	EMCO	EMCO	ROHDESCHWARZ
Model No.	3104C	3146	ESCI
Calibration Date	Nov. 01, 2013	Apr. 30, 2013	Nov. 20, 2013
Calibration Due Date	May. 01, 2015	Oct. 30, 2014	Nov. 20, 2014

Equipment	Double Ridged Guide Antenna	Broad-Band Horn Antenna	Spectrum Analyzer
Registration No.	EW-1015	EW-1679	EW-2466
Manufacturer	EMCO	SCHWARZBECK	R&S
Model No.	3115	BBHA9170	FSP30
Calibration Date	Mar. 05, 2013	Apr. 01, 2013	Aug. 4, 2013
Calibration Due Date	Sep. 05, 2014	Apr. 01, 2014	Aug. 4, 2014

2) Conductive Measurement Test

Equipment	Spectrum Analyzer
Registration No.	EW-2466
Manufacturer	R&S
Model No.	FSP30
Calibration Date	Aug. 4, 2013
Calibration Due Date	Aug. 4, 2014

END OF TEST REPORT